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an age at which an individual seldom can enter even a state legislature in this country. Fox was chosen to the house before he was twenty, Pitt before he was twenty two.

Again, parliament is a profession, and a man becomes as skilful and as much attached to it, as to that vocation by which he earns his bread. The distinguished men in the house of commons remain there twenty and thirty years, and many of them as long as they live. The consequence of this is, that they not only become greater men themselves, but learn to do the business of the nation with greater despatch. We believe that the members from Virginia and South Carolina remain in congress longer than those from the New England states, where an opposite policy, either arising from the caprice of the people, or the circumstances of the candidate, prevails to a fatal degree. We may also observe, that all the distinguished English statesmen from the time of Queen Anne, appear to have been accomplished scholars, and particularly well versed in the Latin language. This was especially the case with the Pitts, father and son, though the practice of quoting Latin in parliament is much diminished, and we have seen it stated by a person of great experience in those matters, that Mr Pitt did not make more than a dozen citations from the classics, in the whole course of his ministry.

ART. XI.—*Report upon Weights and Measures. By John Quincy Adams, Secretary of State of the United States. Prepared in obedience to a resolution of the Senate of the 3d of March* 1817. 8vo. pp. 245. Washington.

To one who has never had occasion to turn his attention to the history and philosophy of weights and measures, it may appear surprising that the subject should have called for all the learning, and research, and wisdom, displayed in this work. Though foreign to the ordinary duties of a statesman, the senate of the United States seem to have been fully aware of the importance and difficulty of the question before them, and of the qualifications for treating it of the distinguished individual to whom they referred it; and we deem it matter of great congratulation, that congress have, by their prudence and caution, hitherto escaped the evils into which other governments have so often been betrayed by unwary and precipitate measures; and that they have at length, in this ample and elaborate document, the means of acting with a more enlarged and more just view of the subject, than has fallen to the lot of any other legislative body.

There are, we think, few subjects of legislation that impose a severer responsibility upon the supreme authority of a state, than that under consideration. An army, a navy, a revenue, &c., call for measures of a comparatively restricted application, and measures whose operation is, for the most, silent and unobserved. But a new regulation, with regard to weights and measures, extends to almost every individual of a community, and controls him in his daily business, and in his habitual transactions with others. It is difficult to conceive how a despot could make his power felt more generally and constantly, or more vexatiously, than by requiring new systems of weights and measures. So, on the other hand, there are few subjects on which some authoritative regulation is more clearly and indispensably necessary, and in which a wise government can more certainly and more effectually promote the cause of justice and fair dealing among a people.

In a reformation of the existing system of weights and measures, which has been repeatedly called for in this, as well as in other countries, several essential changes have been proposed. It has been thought, in the first place, highly important to refer all our measures to some natural standard, that shall remain immutable amid the revolutions to which human things are liable, and which may be recovered when all artificial measures shall be lost or impaired. It is true, that the measures now in use were originally taken from nature; but they were taken from objects in themselves variable. Most measures of length, as the foot, the cubit, the span, the fathom, were borrowed from the human body. The reason of this is evident. Measures were originally employed with direct reference to the human person. They were to be applied almost exclusively to articles of clothing and shelter, or to instruments of war and the chase, and which of course were to be used about the person, and to be adapted to it, in their dimensions and physical qualities. The pace, or length of a single step, was intended for spaces of greater extent, and a mile, as the name imports, was an abridged expression for a thousand of these paces. But when it was found necessary to compare these different lengths with each other, an inconvenience must have arisen from having so many independent measures, and from their not being of a determinate magnitude. It was a great improvement, therefore, and one which probably took place at an early period, to consider some one of these measures as fixed and unalterable, and instead of measuring one thing with the breadth of the hand, and another with the length of the foot, and another with the two arms extended, to refer all these different independent lengths to the same assumed standard, and to regard them as exact parts or multiples of this standard. The measure, thus adopted, has been in some instances the cubit, or extent from the elbow to the end of the middle finger, in others the yard,* but most generally the foot. The measure known by this latter name has been different at different times, and in different places, and though it was originally borrowed from the length of the human foot, is now purely conventional, and does not admit of being restored in the event of its being lost.

By a natural standard we mean one that is constant, and capable of being determined with precision. Several of this description have been suggested, as the pendulum beating seconds, a certain part of the diameter or circumference of the earth, the space described by a falling body near the surface of the earth, &c. The pendulum has been often recommended, and would seem to be particularly adapted to this purpose, on account of the facility and exactness with which its length can be determined. But there are several circumstances, not apparent at first view, which materially affect its claims to this distinction. It requires to be of different lengths in different latitudes, in order to vibrate seconds, and it is of great importance to its general adoption, that the standard should be equally suited to all places on the earth. Besides this, the pendulum involves the consideration of time, and the arbitrary division of the day into eighty-six thousand four hundred seconds, and if the loss of measures at any future time should be attended with the loss of the present manner of dividing the day, it would still be impossible to recover them.

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* 'The *yard*, or *girth*,' is thought to be 'a measure of Saxon origin, derived, like those of the Hebrews and the Greeks, from the human body, but, as a natural standard, different from theirs, being taken not from the length or members, but from the circumference of the body. The yard of the Saxons evidently belongs to a primitive system of measures different from that of Greeks, of which the foot, and from that of the Hebrews, Egyptians, and Antediluvians, of which the cubit, was the standard. It affords, therefore, another demonstration, how invariably nature first points to the human body, and its proportions, for the original standards of linear measure. But the yard being for all purposes of use, a measure corresponding with the ulna, or ell, of the Roman system, became, when superadded to it, a source of diversity, and an obstacle to uniformity in the system. The yard, therefore, very soon after the Roman conquest, is said to have lost its original character of girth; to have been adjusted as a standard by the arm of king Henry the First; and to have been found or made a multiple of the foot, thereby adapting it to the remainder of the system; and this may, perhaps, be the cause of the difference of the present English foot from that of the Romans, by whom, as a measure, it was introduced.' *Report, &c. p.* 21.

After much inquiry and discussion, it has been thought by those best qualified to judge, that a certain portion of the meridian of the earth affords the best standard that nature offers us. It can be determined with sufficient accuracy. It is common to all the inhabitants of the earth. By means of it, all our journeys and voyages are estimated in certain proportional parts of the whole circuit of the globe; and the territories and countries, which we have occasion to survey, are directly compared to the entire surface of the planet we inhabit. We might also mention, that by adopting the same decimal scale for the quadrant of a circle, absolute distances and degrees upon the earth's surface would be immediately known the one from the other.

Another object proposed by the advocates for reform is, that there should be only one weight, and one measure, under the same name. At present a pound, an ounce, a dram, mean each different things, according to the article to be weighed; and a gallon of wine is one quantity, and a gallon of beer is another, and a gallon of corn is another. It would seem that only one unit of weight is necessary for all articles that are to be weighed, and only one unit of capacity for all such as are estimated by bulk. It would, moreover, be a great convenience to have the several kinds of coin represent different established weights, so that weights and coins might be mutually standards and checks to each other.

But one of the principal inconveniences of the existing system of weights and measures arises from the arbitrary manner, in which the different denominations proceed. Thus, three barley corns make an inch, twelve inches a foot, three feet a yard, five and a half yards a pole, forty poles a furlong, and eight furlongs a mile. The denominations of weight and capacity are equally anomalous and ill adapted to calculation.

It is very evident, that if the several terms denoting weight, and also those which stand for the different measures of length, of surface, capacity, time, &c., were so contrived that each higher denomination should be just ten times the next lower, we might save ourselves all the trouble and perplexity of compound arithmetic. Mercantile questions of every description would be readily solved by the simple rules of addition, subtraction, multiplication, and division.

It may be further added, that the advantages which would result to any one nation in particular, from such a reform, would be greatly increased, if several nations, connected by commerce and letters, could be persuaded to adopt the same system.

It would seem now an easy matter to devise a system embracing the foregoing advantages, and to give it the authority of a law. This has in fact been done, and one leading object of the report before us is, to furnish a statement of the proceedings in foreign countries relative to this subject.

The learned author first makes us acquainted with the English system in its origin, and the changes it has undergone. This it seems has descended to us from the remotest times. It has grown up with man and human society. It has accommodated itself in a greater or less degree to our wants, both physical and intellectual. It has advantages, derived from its long establishment, from the manner in which it has been formed, and from its being combined with so many of our arts and trades, that would be an overbalance to many theoretical excellencies. But it has also many acknowledged defects, some that are inherent in its original structure, and others that have been superadded to it, by the inconsistency of human laws. The changes, however, that have taken place in latter times seem to have been incidental, and not from designed innovation. The government appears to have interfered only to announce and fix the system that had been adopted to a greater or less extent by common consent, and had been in use time out of mind. Of this import is the statute of 1266, (51 Henry III,) which, after re-enacting certain ordinances of long standing relating to the assize of bread, ale, &c.

'Declares, that, " by the consent of *the whole realm* of England, the *measure* of the king was made; that is to say, that an English *penny*, called a sterling round, and without any clipping, shall weigh thirty-two wheat corns in the midst of the ear, and twenty-pence do make an ounce, and twelve ounces one pound, and eight pound do make a gallon of *wine*, and eight gallons of *wine* do make a London bushel, which is the eighth part of a quarter."

'Henry the Third was the eighth king of the Norman race: and this statute was passed exactly two hundred years after the conquest. It is merely an exemplification, word for word, embracing several ordinances of his progenitors, kings of England; and it unfolds a system of uniformity for weights, coins, and measures of capacity, very ingeniously imagined, and skilfully combined.

'It shows, first, that the money weight was identical with the silver coins: and it establishes an uniformity of proportion* between the money weight and the merchant's weight, exactly corresponding to that between the measure of wine and the measure of grain.

'It makes wheat and silver money, the two weights of the balance, the natural tests and standards of each other; that is, it makes wheat the standard for the weight of silver money, and silver money the standard for the weight of wheat.

'It combines an uniformity of proportion between the weight and the measure of wheat and of wine; so that the measure of wheat should at the same time be a certain weight of wheat and the measure of wine at the same time a certain weight of wine, so that the article whether bought and sold by weight or measure, the result was the same. To this, with regard to wheat, it gave the further advantage of an abridged process for buying or selling it by the number of its kernels. Under this system, wheat was bought and sold by a combination of every property of its nature, with reference to quantity; that is, by number, weight, and measure. The statute also fixed its proportional weight and value, with reference to the weight and value of the silver coin for which it was to be exchanged in trade. If, as the most eminent of the modern economists maintain, the value of every thing in trade is regulated by the proportional value of money and of wheat, then the system of weights and measures, contained in this statute, is not only accounted for as originating in the nature of things, but it may be doubted whether any other system be reconcileable to nature.' p. 24.

'But neither the present avoirdupois, nor troy weights, were then the standard weights of England. The key-stone to the whole fabric of the system of 1266 was the *weight* of the silver penny *sterling*. This penny was the two hundred and fortieth part of the tower pound; the sterling or easterling pound which had been used at the mint for centuries before the conquest, and which continued to be used for the coinage of money till the eighteenth year of Henry the Eighth, 1527, when the troy pound was substituted in its stead. The tower or easterling pound weighed three quarters of an ounce troy less than the troy pound, and was consequently in the proportion to it of fifteen to sixteen. Its penny, or two hundred and fortieth part, weighed, therefore, twenty-two and a half grains troy; and that was the weight of the thirty-two kernels of wheat from the middle of the ear, which, according to the statute of 1266, had been taken to form the standard measure of wheat for the whole realm of England. It is also to be remembered, that the eight twelve ounce pounds of wheat, which made the gallon of wine, produced a measure which contained nearly ten of the same pounds of wine. The commercial pound, by which wine and most other articles were weighed, was then of fifteen ounces.' pp. 25, 26.

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* Frequent use is made of the expressions *uniformity of identity* and *uniformity of proportion*, which are explained at the beginning of the Report.

'By an uniformity of *identity*,' says the author, 'is meant a system founded on the principle of applying only one unit of weights to all weighable articles, and one unit of measures of capacity to all substances thus measured, liquid or dry.

'By an uniformity of *proportion*, is understood a system admitting more than one unit of weights, and more than one of measures of capacity; but in which all the weights and measures of capacity are in an uniform proportion with one another.' *Report, p.* 6.

'This system of weights and measures has been, by many of the modern English writers on the subject, supposed to have been *established* by the statute of 1266. But, upon the face of the statute itself, it is a mere exemplification of ancient ordinances. The coincidences in its composition with those of the ancient Romans, proved by the letter of the Silian law, and by the still existing congius of Vespasian; with those of the Greeks, as described by Galen, and as shown by the proportions between their scale weight and their metrical weight; and with that of the Hebrews, as described in the prophecy of Ezekiel; show that its origin is traceable to Egypt and Babylon, and there vanishes in the darkness of antiquity. As founded upon the identity of nummulary weights and silver coins, and upon the relative proportion between the gravity and extension of the first articles of human traffic, corn and wine, it is supposed to have originated in the nature and relations of social man, and of things.' p. 29.

'The first inroad upon this system in England was made by Edward the First himself, by destroying the identity between the money weight and the silver coin. From the time of the Norman conquest, and long before, that is, for a space of more than three centuries, the tower, easterling, or sterling pound had been coined into twenty shillings, or two hundred and forty of those silver *pennies*, each of which weighed thirty-two kernels of wheat from the middle of the ear. Edward the First, in the year 1328, coined the same pound into two hundred and forty-three pennies of the same standard alloy. From the moment of that coinage, the penny called a sterling, however round, however unclipped, had lost the *sterling* weight, though it still retained the name. This debasement of the coin, once commenced, was repeated by successive sovereigns, till in the reign of Edward the Third, the pound was coined into twenty-five shillings, or three hundred pennies. The silver penny then weighed only $25\frac{3}{5}$ kernels of that wheat, of which the penny of 1266 weighed thirty-two. It is probable that, in reducing the weight of their coins, none of those sovereigns were aware that they were taking away the standard of all the weights and of all the vessels of measure, liquid and dry, throughout the kingdom: but so it was. It destroyed all the symmetry of the system. It has been further affected by the introduction of the troy and avoirdupois weights.' pp. 29, 30.

'The statute of 1496 inverts the order of the old statutes; it is not a *composition*, but an *analysis*, of measures. It begins with the bushel, and descends to the kernel. The act of 1266, to make the weight, number, and measure, of corn, money, and wine, begins with the kernel, and ascends by steps to the weight of coin; thence to the measure of wine, by the weight of corn; thence to the measure of corn, by the weight of wine. The mere process of the composition establishes the proportional measures. The statute of 1496 destroys the proportion altogether. It says that every gallon shall contain eight pounds of wheat *troy weight*, and every pound twelve ounces of troy weight. It substitutes, therefore, instead of the *weight* of the gallon of wine, prescribed by the statute of 1266, the *measure* of the wine gallon for the eighth part of the bushel. The gallon, established by this act of 1496, is the gallon of two hundred and twenty-four cubic inches; the Guildhall gallon, which in 1688 was found by the commissioners of the excise to be of that capacity. It contains eight pounds troy weight of wheat, and, consequently, eight pounds avoirdupois of Bordeaux wine, of two hundred and fifty grains troy to the cubic inch. Its bushel would contain seventeen hundred and ninety-two cubic inches; but if such a bushel ever was made, as the act required, it never was used as a standard. It must have been found to fall too far short of the old standards still existing; and the real standard bushels of Henry the Seventh, in the exchequer, instead of being made according to the process prescribed in his law of 1496, must have been copied from the older standard bushels then existing.

'The gallon of two hundred and thirty-one inches,* was also a gallon made under the statute of 1496. But the wheat is of that kind, thirty-two grains of which equipoise the penny of the old tower pound; while the wheat that forms the gallon of two hundred and twenty-four inches, is that of which thirty-two kernels weigh a penny weight troy. The weight of the corn in both gallons would be the same; but that, of which each kernel upon the average would be one sixteenth heavier than those of the other, would, by the combined proportion of gravity and numbers, occupy one thirty-second less of space. This is precisely the difference between the gallons of two hundred and twenty-four and two hundred and thirty-one solid inches.

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* This content of the wine gallon was made the subject of an express statute under Queen Anne, and has remained unchanged ever since. *Report*, p. 43.

'The debasement of the coin had destroyed its original identity with the money weight. The substitution of *troy* weight, instead of the old easterling pound, for the composition of the gallon, destroyed the coincidence between the water gallon, derived from the ton, the eighth part of the cubic foot, and the wine gallon, containing eight money pounds of wheat. The wine gallon of two hundred and twenty-four, or two hundred and thirty-one cubic inches, no longer bore the same proportion to the cubic foot of water; one consequence of which was, that the hogshead of Bordeaux wine, which the law required to contain sixty-three gallons, no longer contained that number of English gallons; but, from that day to this, has contained from fifty-nine to sixty-one.' pp. 31, 32.

'By the English system of weights and measures before the statute of 1496, the London quarter of a ton was the one measure, to which the bushel for corn, the gallon, deduced by measure, for ale, and the gallon, deduced by weight, for wine, were all referred. The hogshead was a vessel deduced from the cubing of linear measure, containing sixty-three gallons, and measuring eight cubic feet. The gallon thus formed, contained 219.43 cubic inches. This wine gallon, by another law, was to contain eight twelve ounce pounds of wheat. One such pound of wheat, therefore, occupied 27.45 cubic inches. The vessel of eight times 27.45 cubic inches filled with wine, the liquor would weigh 54,857.1 grains of troy weight: and the weight of eight such gallons of wine would be 438,856.8 grains troy. The specific gravity of wine being to that of wheat as 175 to 143, the bushel thus formed would be of 2148.5 cubic inches; and its eighth part, or ale gallon, would be 268.5 inches. This is only two inches more than the standard Winchester bushel of the exchequer was found to contain, and two inches less than the bushel as prescribed by the act of 13 William III.; a difference which a variation in the temperature of the atmosphere is of itself adequate to produce. It proves, that the Winchester bushel* has not without reason been preserved as the favorite of all standards, in spite of all the changes, errors, and inconsistencies, of legislation. But it also proves, that the ale and corn gallon ought to have continued as they originally were, of 268½ inches, and the wine gallon of 219½.

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* The Winchester bushel of 2145.6 cubic inches made in the reign of Henry the Seventh, is supposed with good reason to be copied from a standard which had been kept at Winchester when that place was the capital of the kingdom. *Report, p.* 55.

'The troy and avoirdupois weights are in the proportions to each other of the specific gravity of wheat and of spring water. The twelve and fifteen ounce easterling pounds were intended to be proportional between the gravity of wheat and wine. But they were roughly settled proportions, estimating the weight of wheat to be to that of wine as four to five, and the gravity of wine and of water to be the same. Under the statute of 1496, the wine gallon was of 224 inches. If troy weight was to be introduced, a gallon of this capacity had the great advantage upon which the proportion of uniformity had originally been established. The gallon contained exactly eight pounds avoirdupois of wine. The pint of wine was a pound of wine. The corn gallon of 272 inches corresponding with it, had the same advantage. It was filled with eight pounds of corn: a pint of wheat was a pound of wheat; and the bushel of 2176 inches contained 64 pounds avoirdupois of that wheat, 32 kernels of which weighed one pennyweight troy. But the hogshead, being of eight cubic feet, could have contained only 61¾ gallons, and the ton would have been of 247.

'The wine and ale gallons, now established by law, of 231 and 282 inches, are still in the same proportion to each other as the troy and avoirdupois weights: but neither of them is in any useful proportion to the bushel. The corn gallon only is in proportion to the bushel. Neither the wine nor the corn gallons are in any useful proportion either to the weights or the coins. But the troy and avoirdupois weights are, with all the exactness that can be desired, standards for each other: and the cubic foot of spring water weighs exactly 1000 ounces avoirdupois, by which means the ton, of thirty-two cubic feet measure, is in weight exactly 2000 pounds avoirdupois.

'Such was originally the system of English weights and measures, and such is it now in its ruins. The substitution of cubic inches, to settle the dimensions of the gallons and bushels, which began with the last century, was a change of the *test* of their contents from gravity to extension. They had before been measured by number, weight, and measure: they are now measured by measure alone. This change has been of little use in promoting the principle of uniformity. As it respects the natural standard, it has only been a change from the weight of a kernel of wheat to the length of a kernel of barley: and although it has specified the particular standard bushels and gallons, selected among the variety, which the inconsistencies of former legislation had produced, it has very unnecessarily brought in a third gallon measure quite incompatible with the primitive system; and it has legalized two bushels of different capacity, so slightly different as to afford every facility to the fraudulent substitution of the one for the other; yet, in the measurement of quantities, resulting in a difference of between three and four per cent.

'No further change in this portion of English legislation has yet been made. But the philosophers and legislators of Britain have never ceased to be occupied upon weights and measures, nor to be stimulated by the passion for uniformity. In speculating upon the theory, and in making experiments upon the existing standards of their weights and measures, they seem to have considered the principle of *uniformity* as exclusively applicable to identity, and to have overlooked or disregarded the uniformity of proportion. They found a great variety of standards differing from each other: and instead of searching for the causes of these varieties in the errors and mutability of the law, they ascribed them to the want of an immutable standard from *nature*. They felt the convenience and the facility of decimal arithmetic for *calculation*; and they thought it susceptible of equal application to the divisions and multiplications of *time*, *space*, and *matter*. They despised the primitive standards assumed from the stature and proportions of the human body. They rejected the secondary standards, taken from the productions of nature most essential to the subsistence of man; the articles for ascertaining the quantities of which, weights and measures were first found necessary. They tasked their ingenuity and their learning to find, in matter or motion, some *immutable* standard of linear measure, which might be assumed as the single universal standard from which all measures and all weights might be derived.' pp. 44—46.

'After a succession of more than sixty years of inquiries and experiments, the British parliament have not yet acted in the form of law. After nearly forty of the same years of separate pursuit of the same object, *uniformity*, the congress of the United States have shown the same cautious deliberation: they have yet authorized no change of the existing law. That neither country has yet changed its law, is, perhaps, a fortunate circumstance, in reference to the principle of uniformity for both. If this report were authorized to speak to both nations, as it is required to speak to the legislature of one of them, on the subject in which the object of pursuit is the same for both, and the interest in it common to both, it would say—Is your object *uniformity?* Then before you change any part of your system, such as it is, compare the uniformity that you must lose, with the uniformity that you may gain by the alteration. At this hour, fifteen millions of Britons, who, in the next generation, may be twenty, and ten millions of Americans, who, in less time, will be as many, have the same legal system of weights and measures. Their mile, acre, yard, foot, and inch—their bushel of wheat, their gallon of beer, and their gallon of wine, their pound avoirdupois, and their pound troy, their cord of wood, and their ton of shipping, are the same. They are of the nations of the earth, the two, who have with each other the most of that intercourse which requires the constant use of weights and measures. Any change whatever in the system of the one, which should not be adopted by the other, would destroy all this existing uniformity. Precious, indeed, must be that uniformity, the mere promise of which, obtained by an alteration of the law, would more than compensate for the abandonment of this.' pp. 46, 47.

After this minute and critical examination of the English system of weights and measures, of which we are able to present but a small part to our readers, the author proceeds to give a detailed account of the celebrated modern French system. The English system, as we have already hinted, the system which, till lately, has prevailed in its more essential features throughout Europe, is the work of time, and the result of successive expedients resorted to as the occasion required. The new system of France is the fruit of an enlightened philosophy. It regards man in his social, improved state. It has respect, not only to his necessities, but to his comforts, his convenience, his improvement. It looks less indeed to his animal, than to his intellectual wants, less to the common occasions of life, than to the refinements of art and science, less to the every day concerns of individual man, than to the vast and multiplied intercourse of nations.

'It is one of those attempts to improve the condition of human kind, which, should it even be destined ultimately to fail, would, in its failure, deserve little less admiration than in its success. It is founded upon the following principles:

1. That all weights and measures should be reduced to one *uniform* standard of linear measure.
2. That this standard should be an aliquot part of the circumference of the globe.
3. That the unit of linear measure, applied to matter, in its three modes of extension, length, breadth, and thickness, should be the standard of all measures of length, surface, and solidity.
4. That the cubic contents of the linear measure, in distilled water, at the temperature of its greatest contraction, should

furnish at once the standard weight and measure of capacity.

5. That for every thing susceptible of being measured or weighed, there should be only one measure of length, one weight, one measure of contents, with their multiples and subdivisions exclusively in decimal proportions.
6. That the principle of decimal division, and a proportion to the linear standard, should be annexed to the coins of gold, silver, and copper, to the monies of account, to the division of *time*, to the barometer and thermometer, to the plummet and log lines of the sea, to the geography of the earth and the astronomy of the skies; and, finally, to every thing in human existence susceptible of comparative estimation by weight or measure.
7. That the whole system should be equally suitable to the use of all mankind.
8. That every weight and every measure should be designated by an appropriate, significant, characteristic name, applied exclusively to itself.' pp. 47, 48.

According to this scheme, the unit of linear measure and basis of the whole system, is the ten millionth part of the quadrant of the meridian, extending from the equator to the pole. This is called the *metre*, and is almost exactly the length of the seconds' pendulum at Paris, or 39⅓ English inches nearly. A cube, whose side is one tenth of a metre, constitutes the unit of measures of capacity. It is called the *litre*, and is equal to about 2⅛ English pints. The unit of weights is the *gramme*. It is the weight *in vacuo* of a quantity of pure water, at its maximum of density, that shall exactly fill a cubical vessel, each side of which is one hundredth part of the metre. It is equivalent to about 15½ grains Troy. In land measure the unit, called the *are*, is a square surface, each of whose sides is ten metres. It is nearly equal to ten perches. The unit of measure for fire wood, denominated the *stere*, is a cubic metre, containing about 35⅓ English cubic feet, or somewhat more than one fourth of a cord. Each of these units is decimally divided and subdivided. Multiples also are taken according to this same decimal scale. To express the denominations less than the unit, the words *deci*, *centi*, *milli*, borrowed from the Latin language, are prefixed to the unit to signify a tenth, a hundredth, a thousandth, of this quantity respectively. In like manner the multiples of each unit are denoted by significant names, the prefixed syllables being derived from the Greek language. Thus, while *deci-metre*, *centi-metre*, &c., mean a tenth part, a hundredth part, &c., of a metre, *deca-metre* stands for ten metres, *hecto-metre* for one hundred metres, *kilo-metre* for one thousand metres, and *myria-metre* for ten thousand metres. The same prefixes are applied to each of the several units, and furnish all the requisite denominations.*

'The theory of this nomenclature,' it is justly remarked, 'is perfectly simple and beautiful. Twelve new words, five of which denote the things, and seven the numbers, include the whole system of metrology; give distinct and significant names to every weight, measure, multiple, and subdivision, of the whole system; discard the worst of all the sources of error and confusion in weights and measures, the application of the same name to different things; and keep constantly present to the mind the principle of decimal arithmetic, which combines all the weights and measures, the proportion of each weight or measure with all its multiples and divisions, and the chain of uniformity which connects together the profoundest researches of science with the most accomplished labors of art and the daily occupations and wants of domestic life, in all classes and conditions of society.' p. 55.

This plan, thus matured, required several scientific operations to be performed, namely,

'1. To measure an arc of the meridian from Dunkirk to Barcelona, being between nine and ten degrees of latitude, including the 45th, with about six to the north and three to the south of it, and to make upon this line all suitable astronomical observations.

'2. To measure anew the bases, which had served before for the admeasurement of a degree in the construction of the map of France.

'3. To verify, by new observations, the series of triangles, which had been used on the former occasion, and to continue them to Barcelona.

'4. To make, at the 45th degree of latitude, at the level of the sea, *in vacuo,* at the temperature of melting ice, observations to ascertain the number of vibrations in a day of a pendulum equal to the ten millionth part of the arc of the meridian.

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* The coins and monies of account were not originally a part of the above system. They were made to conform to it by adopting the *franc*, a name previously in use, and synonymous with livre, as the unit of both. The weight of this coin, in silver having one tenth alloy, was fixed at five *grammes*; its tenth part was called *décime*, and its hundredth part *centime*. The reformation was extended also to the calendar. The months were made to consist of thirty days each, and were divided respectively into three weeks of ten days each; the day was divided into ten hours, and the hour into an hundred minutes, and the minute into a hundred seconds. New and significant names were applied to the months of the year and days of the week. This part of the decimal reform has been entirely abolished.

'5. To ascertain, by new experiments, carefully made, the weight *in vacuo,* of a given mass of distilled water at the freezing point.

'6. To form a scale and tables of equalization between the new measures and weights proposed, and those which had been in common use before.' pp. 50, 51.

The three first of these operations were committed to Mechain and Delambre; 'the experiments upon the pendulum to Borda, Mechain, and Cassini; those on the weight of water to Lefevre Gineau and Fabbroni; and the scale and tables to a large committee on weights and measures.'

'The reports of the proceedings of Delambre and Mechain, as well of their field surveys as of their astronomical observations, and all their calculations, were submitted to the inspection, scrutiny, and revision, of a committee of the mathematical and physical class of the national institute, that phœnix of science, which had arisen from the ashes of the academy of sciences. The observations to ascertain the length of the pendulum, and the experiments for determining the specific gravity of distilled water at its maximum of density, were submitted to the same ordeal. Two reports upon the whole result were made to the class, one by Trallés of the Helvetic Confederation, the other by Van Swinden of the Netherlands, two of the foreign associates, who had been invited to co-operate in the labor, and to participate in the honor of the undertaking. These two reports, combined by Van Swinden into one, were then reported from the class to the general meeting of the institute, and by that body, with all suitable solemnity, to the two branches of the national assembly of France, on the 22d of June, 1799, together with a definitive metre of platina, made by Lenoir, and a kilogramme of the same metal, made by Fortin. They were introduced by an appropriate address at the bar of the two houses, by the presiding member of the national institute, La Place; to which answers were returned by the respective presidents of the two legislative chambers. On the same day, the standard metre and kilogramme were deposited in the hands of the keeper of the public archives; and a record of the fact was made and signed by him, and by all the members of the institute, foreign associates, and artists, whose joint labors had contributed to the consummation of this more than national undertaking.' pp. 58, 59.

This system, so admirable in theory, has now been in operation, or rather had the sanction of a public law, more than twenty years, and notwithstanding it was the work of the nation, its pride and boast, notwithstanding the genius of the times was so favorable to change, and notwithstanding it has had all the support that the most powerful government could give it, it has still been resisted, and if we are correctly informed, is very far from being actually adopted by the great body of the people. Among the difficulties with which it has had to contend, one of the greatest has arisen from its nomenclature. We have already mentioned that twelve names were found sufficient for all the purposes of weight and measure. And yet, to use the expressive language of the report,

'The French nation have refused to learn, or to repeat these twelve words. They have been willing to take a total and radical change of things; but they insist upon calling them by old names. They take the metre; but they must call one-third part of it a foot. They accept the kilogramme; but, instead of pronouncing its name, they choose to call one half of it a pound. Not that the third of a metre is a foot, or the half of a kilogramme is a pound; but because they are not very different from them, and because, in expressions of popular origin, distinctness of idea in the use of language is more closely connected with habitual usage than with precision of expression.

'This observation may be illustrated by our own experience, in a change effected by ourselves in the denominations of our coins, a revolution by all experience known to be infinitely more easy to accomplish than that of weights and measures. At the close of our war for independence, we found ourselves with four English words, pound, shilling, penny, and farthing, to signify all our monies of account. But, though English words, they were not English things. They were no where sterling: and scarcely in any two states of the Union were they representatives of the same sums. It was a Babel of confusion by the use of four words. In our new system of coinage we set them aside. We took the Spanish piece of eight, which had always been the coin most current among us, and to which we had given a name of our own—a dollar. Introducing the principle of decimal divisions, we said a tenth part of our dollar shall be called a *dime*, a hundredth part a *cent*, and a thousandth part a *mille*. Like the French, we took all these new denominations from the Latin language; but instead of prefixing them as syllables to the generic term dollar, we reduced them to monosyllables, and made each of them significant by itself, without reference to the unit, of which they were fractional parts. The French themselves, in the application of their system to their coins, have followed our example; and, assuming the franc for their unit, call its tenth part a *decime*, and its hundredth a *centime*. It is now nearly thirty years since our new monies of account, our coins, and our mint, have been established. The dollar, under its new stamp, has preserved its name and circulation. The cent has become tolerably familiarized to the tongue, wherever it has been made by circulation familiar to the hand. But the dime having been seldom, and the mille never presented in their material images to the people, have remained so utterly unknown, that now, when the recent coinage of dimes is alluded to in our public journals, if their name is mentioned, it is always with an explanatory definition to inform the reader, that they are ten cent pieces; and some of them which have found their way over the mountains, by the generous hospitality of the country, have been received for more than they were worth, and have passed for an eighth, instead of a tenth part of a dollar. Even now, at the end of thirty years, ask a tradesman, or shopkeeper, in any of our cities, what is a dime or a mille, and the chances are four in five that he will not understand your question. But go to New York and offer in payment the Spanish coin, the unit of the Spanish piece of eight, and the shop or market-man will take it for a *shilling*. Carry it to Boston or Richmond, and you shall be told it is not a shilling, but nine pence. Bring it to Philadelphia, Baltimore, or the City of Washington, and you shall find it recognized for an eleven-penny bit; and if you ask how that can be, you shall learn that, the dollar being of ninety pence, the eighth part of it is nearer to eleven than to any other number: and pursuing still further the arithmetic of popular denominations, you will find that half eleven is five, or, at least, that half the eleven-penny bit is the fi-penny bit, which fi-penny bit at Richmond shrinks to four pence half-penny, and at New York swells to six pence. And thus we have English denominations most absurdly and diversely applied to Spanish coins; while our own lawfully established dime and mille remain, to the great mass of the people, among the hidden mysteries of political economy—state secrets.

'Human nature, in its broadest features, is every where the same. This result of our own experience, upon a small scale, and upon a single object, will easily account for the repugnance of the French people to adopt the new nomenclature of their weights and measures. It is not the length of the words that constitutes the objection against them, nor the difficulty of pronunciation; for, fi-penny bit is as hard to speak and as long a word as kilogramme, and eleven-penny bit has certainly more letters and syllables, and less euphony, than myria-metre. But it is because, in the ordinary operations of the mind, distinctness of idea is, by the laws of nature, linked with the chain of association between sensible images and their habitual denominations, more closely than with the exactness of logical analysis.' pp. 55–57.

Various expedients have been resorted to by the French government at different times to accommodate the new system to the unyielding habits and usages of the people. These amount, as will appear by the following extract, to an abandonment of almost every thing but the several units of measure and weight.

'An imperial decree of 12th February 1812, presents the subject under a new aspect, by ordaining,

'1. That the *units* of weights and measures should remain unchanged, as established by the law of 10th December 1799.

'2. That the minister of the interior should cause to be made *instruments* for weight and mensuration, presenting the fractions or multiples of the said units the most commonly used in commerce, and accommodated to the wants of the people.

'3. That these instruments should bear on their respective faces the comparison of the divisions and denominations established by law, with those which had been formerly used.

'4. That after a term of ten years a report should be made to the emperor of the result of experience upon the improvements, of which the system of weights and measures might be susceptible.

'5. That in the mean time the legal system should continue to be taught in all the schools, and be exclusively used in all the public offices, and in all markets, halls, and commercial transactions.

'For the execution and explanation of this decree, an ordinance was, on the 28th of March, 1812, issued by the minister of the interior, of the following purport:

'Art. 1. Permission was granted to employ for the purpose of commerce

'1. A long measure equal to two metres, to be called a toise, and to be divided into six feet:

'2. A measure equal to one third of the metre, to be called a foot, to be divided into twelve thumbs, and the thumb into twelve lines.

'Each of these measures shall bear on one side the corresponding divisions of the metre, that is to say: the toise, two metres, divided into decimetres, and the first decimetre into millimetres; and the foot, three decimetres and one third, divided into centimetres and millimetres, in all $333\frac{1}{3}$ millimetres.

'Art. 2. All cloths may be measured by a stick equal in length to twelve decimetres, to be called an *ell*, (aune,) which shall be divided into halves, quarters, eighths, and sixteenths, as well as into thirds, sixths, and twelfths. It shall bear on one of its sides the corresponding divisions of the metre, in centimetres only; that is to say, one hundred and twenty centimetres, numbered from ten to ten.

‘Art. 4. Corn and other dry measure articles may be measured, *in sales at retail*, by a vessel equal to one-eighth of the hectolitre, which shall be called a boisseau, and shall have its double, its half, and its quarter.

‘Art. 5. For *retail* sales of corn, seeds, meal, and roots, green or dry, the litre may be divided into halves, quarters, and eighths.

‘Art. 7. For *retail* sales of wine, brandy, and other liquors, measures of one-quarter, one-eighth, and one-sixteenth of the litre may be used; each of which measures shall be called by a name signifying its proportion to the litre.

‘Art. 8. For retail sales of all articles which are sold by weight, the shopmen may employ the following *usual* weights:

‘The pound, (livre,) equal to half a kilogramme, or 500 grammes, which shall be divided into sixteen ounces.

‘The ounce, (once,) or sixteenth part of the pound, which shall be divided into eight gros.

‘The gros, or eighth part of the ounce, which shall be divided into halves, quarters, and eighths.

‘They shall bear, with their appropriate names, the indication of their weight in grammes, namely:

The pound	500 grammes
Half pound	250
Quarteron	125
Eighth, or ½ quarter	62.5
Ounce	31.3
Half ounce	15.6
Quarter ounce, 2 gros	7.8
Gros	3.9

‘And such is at this day the system of weights and measures, or, rather, such are the systems existing in France in their present condition; for, it cannot escape observation, that this decree and explanatory ordinance engraft upon the legal system an entirely new system, founded upon different, and, in many important respects, opposite principles. So that the result hitherto of the most stupendous and systematic effort ever made by a nation to introduce uniformity in their weights and measures, has been a conflict between four distinct systems:

‘1. That which existed before the Revolution.

‘2. The temporary system established by the law of 1st August 1793.

‘3. The definitive system established by the law of 10th December 1799. And,

‘4. The *usual* system *permitted* by the decree of 12th February 1812.

'This last decree is a compromise between philosophical theory and inveterate popular habits. Retaining the principle of decimal multiplication and division for the legal system, it abandons them entirely in the weights and measures which it allows the people to use. Instead of the metre and its decimals, it gives the people a toise of six feet, an aune of three feet and one-fifth, a foot of twelve thumbs, and a thumb of twelve lines. And these measures, instead of divisions exclusively decimal, are divisible in halves, thirds, quarters, sixths, eighths, twelfths, and sixteenths. Instead of a decimated kilogramme, it gives them a pound of sixteen ounces, an ounce of eight gros, and a gros of seventy-two grains. The measures of capacity, wet and dry, have the same indulgence; and while the standard weight and measure are deposited in the national archives, the people have restored to them for use all the names and divisions of their ancient weights and measures, though not the same things. For the toise, which is twice the length of the metre, is not the old toise; the foot, which is the third part of the metre, is not the *pied de roi:* but both are longer measures. The half kilogramme, which is a pound, is not the ancient mark weight pound; nor are the boisseau or litre those of ancient times: they are all respectively near approximations to them.

'If the existing system and practice terminated here, it would be far from having attained the ideal perfection of uniformity; but it is believed that, for a multitude of purposes, with this double and complicated system, there is yet a very extensive remnant in use of that which prevailed before the revolution. It appears, from questions at this time in discussion between the governments of the United States and of France, that the tonnage of the French shipping is calculated by admeasurements in cubic royal feet: and it appears hence probable that, in all the business of ship building, and in practical navigation, those measures are still used. Without positive knowledge of the fact, the analogy of all experience warrants the conjecture, that in every part of France, remote from the capital, not only the use of the old legal system, but of the local weights and measures which prevailed in the various cities and districts of the country, is far from being eradicated.

'The changes which have forced themselves upon the new system, under the attempt to reduce it to practice, should serve as admonitions to correct the errors of theory; but not operate as discouragement to the pursuit of the principal object, *uniformity.* The French metrology, in the ardent and exclusive search for an universal standard from nature, seems to have viewed the subject too much with reference to the nature of things, and not enough to the nature of man. Its authors do not appear to have considered, in all the bearings of the system, the proportions dictated by nature between the physical organization of man, and the *unit* of his weights and measures. The standard taken from the admeasurement of the earth had no reference to the admeasurement and powers of the human body. The metre is a rod of forty inches: and by applying to it exclusively the principle of decimal divisions, no measure corresponding to the ancient *foot* was provided. An unit of that denomination, though of slightly varied differences of length, was in universal use among all civilized nations: and the want of it is founded in the dimensions of the human body. Perhaps for half the occasions which arise in the life of every individual for the use of a linear measure, the instrument, to suit his purposes, must be portable, and fit to be carried in his pocket. Neither the metre, the half metre, nor the decimetre are suited to that purpose. The half metre corresponds indeed with the ancient cubit: but perhaps one of the causes which have every where, since the time of the Greeks, substituted the foot in the place of the cubit, has been the superior convenience of the shorter measure. Besides which, the cubit being the unit, the half cubit might serve the purposes of the foot; but the metre, divisible only by two and by ten, gave no measure practically corresponding with the foot whatever. It appears also not to have been considered, that decimal arithmetic, although affording great facilities for the computation of numbers, is not equally well suited for the divisions of material substances. A glance of the eye is sufficient to divide material substances into successive halves, fourths, eighths, and sixteenths. A slight attention will give thirds, sixths, and twelfths. But divisions of fifth and tenth parts are among the most difficult that can be performed without the aid of calculation. Among all its conveniences, the decimal division has the great disadvantage of being itself divisible only by the numbers two and five. The duodecimal division, divisible by two, three, four, and six, would offer so many advantages over it, that while the French theory was in contemplation, the question was discussed, whether the reformation of weights and measures should not be extended to the system of arithmetic itself, and whether the number twelve should not be substituted for ten, as the term of the periodical return to the unit. Since the establishment of the French system, this idea has been reproduced by philosophical critics, as an objection against it; and Delambre, in the third volume of the Base du Systeme Metrique, p. 302, has considered it, and assigned the reasons for which it had been rejected. He admits, to the full extent, the advantages of a duodecimal over a decimal arithmetic; but alleges the difficulty of effecting the reformation, as the decisive reason against attempting it.' pp. 67—71.

We are next presented with a particular enumeration of the advantages of the French system, contrasted with those of the English, and a full discussion of their respective merits.

'In what then does the superiority of the French system, in all its novelty and freshness, over that of England, in all its decays, theoretically consist?

'1. In an invariable standard of linear measure, taken from nature, and being an aliquot decimal portion of the quarter of the meridian.

'2. In having a single unit of all weights, and a single unit of measures of capacity for all substances, liquid or dry.

'3. In the universal application of the decimal arithmetic, to the multiples and divisions of all weights and measures.

'4. In the convenient proportions by which the coins and money of account are adjusted to each other and to the weights.

'5. In the uniformity, precision, and significancy, of the nomenclature.

'1. If the project of reforming weights and measures had extended, as was proposed by the French system, to the operations of astronomy, geography, and navigation; if the quadrant of the circle and of the sphere had been divided into one hundred degrees, each of one hundred thousand metres; the assumption of that measure would have been an advantage much more important than it is, or can be, in the present condition of the system. Whether it would have compensated for disturbing that uniformity which exists, and which has invariably existed, of the division into ninety degrees, with sexagesimal subdivisions of minutes and seconds, is merely matter of speculation. At least, it has been found impracticable, even in France, to carry it into effect: and, without it, the metre, as the natural standard of the system, has no sensible advantage over the foot. To a perfect system of uniformity for all weights and measures, an aliquot part of the circumference of the earth is not only a better natural standard unit than the pendulum, or the foot, but it is the only one that could be assumed. Every voyage round the earth is an actual mensuration of its circumference. All navigation is admeasurement; and no perfect theory of weights and measures could be devised, combining in it the principle of decimal computation, of which any other natural standard whatever could accomplish the purpose. Its advantages over the pendulum are palpable. The pendulum bears no proportion to the circumference of the earth, and cannot serve as a standard unit for measuring it. Yet a system of weights and measures, which excludes all geography, astronomy, and navigation, from its consideration, must be essentially defective in the principle of uniformity.

'But, if the metre and its decimal divisions are not to be applied to those operations of man, for which it is most especially adapted; if those who circumnavigate the globe in fact are to make no use of it, and to have no concern in its proportions; if their measures are still to be the nonagesimal degree, the marine league, the toise, and the foot; it is surely of little consequence to the farmer who needs a measure for his corn, to the mechanic who builds a house, or to the townsman who buys a pound of meat, or a bottle of wine, to know that the weight, or the measure which he employs, was standarded by the circumference of the globe. For all the uses of weights and measures, in their ordinary application to agriculture, traffic, and the mechanic arts, it is perfectly immaterial what the natural standard, to which they are referrible, was. The foot of Hercules, the arm of Henry the First, or the barley-corn, are as sufficient for the purpose, as the pendulum, or the quadrant of the meridian. The important question to them is, the correspondence of their weight or measure with the positive standard. With the standard of nature, from which it is taken, they have no concern, unless they can recur to it as a test of verification. However imperfect for this end the human foot, or the kernel of wheat or barley, may be, they are at least easily accessible. It is a great and important defect of the systems which assume the meridian or the pendulum for their natural standard, that they never can be recurred to without scientific operations.' pp. 73—75.—

'2. The advantage of having a single unit of all weights and a single unit of measures of capacity, is so fascinating to a superficial view, that it would almost seem presumption to raise a question, whether it be so great as at first sight it appears. The relative value of all the articles which are bought and sold by measures of capacity, is a complicated estimate of their specific gravity and of the space which they occupy. If both these properties are ascertained by one instrument for any one article, it cannot be applied with the same effect to another. Thus the litre, in the French system, is a measure for all grains and all liquids: but its capacity gives a weight only for distilled water. As a measure of corn, of wine, or of oil, it gives the space which they occupy, but not their weight. Now, as the weight of those articles is quite as important in the estimate of their quantities as the space which they fill, a system which has two standard units for measures of capacity, but of which each measure gives the same weight of the respective articles, is quite as uniform as that which, of any given article, requires two instruments to show its quantity; one to measure the space it fills, and another for its weight.' pp. 75, 76.—

'The Romains had the *mina* and the *libra,* the nummulary pound of twelve ounces, and the commercial pound of sixteen. And the Greeks, as well as the Romans, had a weight for small and precious, and a weight for bulky and cheap commodities. The Greeks denominated them by significant terms, *the weight for measure*, and *the weight for money*. Whether the ounce, of which these pounds were composed, was the same, is a subject of much controversy, but of little importance to decide. At the period of the lower empire, these two weights were known by the name of the *eastern* and *western* pound. And the denomination of the former was the same in England : it was the *easterling* pound, and the origin of the term sterling in the English language : it was the pound of the eastern nations, by which Europe was overrun in the decline of the Roman Empire. The avoirdupois pound had the same origin : for it came through the Romans from the Greeks, and through them, in all prabability, from Egypt. Of this there is internal evidence in the weights themselves, and in the remarkable coincidence between the cubic foot and the thousand ounces avoirdupois, and between the ounce avoirdupois and the Jewish silver shekel. The Greek foot was, within a fraction of less than the hundredth part of an inch, the same with that of England. The ounce avoirdupois is the same with the Roman and Attic ounce, and the exact double of the Jewish shekel. The Silian plebiscitum, or ordinance of the Roman people, of the year 509, two hundred and fifty years before the Christian era, declares, that a quadrantal of wine shall be eighty pounds, a congius of wine ten pounds; that six sextarii make a congius of wine, forty-eight sextarii a quadrantal of wine; that the sextarius of liquid and dry measures should be the same ; and that sixteen pounds make the modius. The congius was the Roman gallon, and the modius the Roman peck. The quadrantal was the same as the amphora, and was formed from the cubic foot of water, so that eighty pounds of wine were equal to a cubic foot of water.

'The same combinations are traced with equal certainty to the Greeks and Egyptians : and, if the shekel of Abraham was the same as that of his descendents, the avoirdupois ounce may, like the cubit, have originated before the flood.

'This diversity is, therefore, founded in the nature of things : and may be stated by the following rule : that whatever is sold *by* weight, in *measure*, must have a measure for itself, which will serve for no other article, of different specific gravity ; and as wheat and wine are both articles of that description, as their specific gravities are very materially different, although they are very suitable to be weighed by the same weight, they yet require different measures, to place them in equipoise with that weight. The difference of specific gravity between the vinous and watery fluids is so slight, that neither in the Greek, the Roman, nor the

English system, was there any account taken of it. But with regard to oil, it appears that the Greeks had a separate measure adapted to its specific gravity, which they considered as being in proportion to that of wine or water as nine to ten.

'Notwithstanding, therefore, the first appearance of superior uniformity and simplicity, presented by the single unit of weights, and single measure of capacity in the new system of France, it appears to be more conformable to the order of nature, and more subservient to the purposes of man, that there should be two scales of weight and two measures of capacity, graduated upon the respective specific gravities of wheat and wine, than with a single weight and a single measure, to be destitute of any indication of weight in the measure.

'This conclusion has been confirmed by a very striking fact, which has occurred in France under the new system. By an ordinance of police, approved on the 6th of December, 1808, by the Minister of the Interior, it is prescribed that the sale of oil in Paris by retail shall be *by* weight, in measures, containing five hectogrammes, one double hectogramme, one hectogramme, &c. And these measures, being cylinders of tin, are stamped with initial letters, indicating that one is for sweet oil, and the other for lamp oil. So that here are two new measures of capacity altogether incongruous to the new system, each differing in cubic dimensions from the other, though to measure the single article of oil, and both differing from the litre. They attach themselves indeed to the new system by *weight*, but abandon entirely its pretensions to unity of measure; and fall at once into the principle of the old system, of adapting the measure to the weight.' pp. 76—78.—

'There are conveniences in the intercourse of society, connected with the use of smaller and more minutely perfect weights and measures of capacity, for sales of articles by retail, than by wholesale, and for articles of great price, though of small bulk. Thus, drugs, as articles of commerce, and in gross, are sold by the avoirdupois or commercial pound; used as medicines, in minute quantities, and compounded by the apothecary, they are sold by the smaller or nummulary weight. The laws of Pennsylvania authorize innkeepers to sell beer, *within the house*, by the wine measure; but, for that which they send out of the house, require them to use the beer gallon or quart. In both these cases the difference of the measure forms part of the compensation for the labor and skill of the apothecary, and part of the profits necessary to support the establishment of the publican. There is, finally, an important advantage in the establishment of two units of weights and measures of capacity, by the possession in each of a standard for the verification of the other. It serves as a guard against the loss or destruction of the positive standard of either. The troy and avoirdupois pounds are to each other as 5,760 to 7,000. Should either of these standard pounds be lost, the other would supply the means of restoring it. The same thing might be effected by the measures of beer and of wine. The French system has designated the pendulum as such a standard for the verification of the metre. The English system gives, in each weight and measure, a standard for the other.

'The result of these reflections is, that the uniformity of nature for ascertaining the quantities of all substances, both by gravity and by occupied space, is a uniformity of proportion, and not of identity; that, instead of one weight and one measure, it requires two units of each, *proportioned* to each other; and that the original English system of metrology, possessing two such weights, and two such measures, is better adapted to the only uniformity applicable to the subject, recognized by nature, than the new French system, which, possesing only one weight and one measure of capacity, identifies weight and measure only for the single article of distilled water; the English uniformity being relative to the *things* weighed and measured, and the French only to the instruments used for weight and mensuration.

'3. The advantages of the English system might, however, be with ease adapted to that of France, but for the exclusive application in the latter of the decimal arithmetic to all its multiples and subdivisions. The decimal numbers, applied to the French weights and measures, form one of its highest theoretic excellencies. It has, however, been proved by the most decisive experience in France, that they are not adequate to the wants of man in society: and, for all the purposes of retail trade, they have been formally abandoned. The convenience of decimal arithmetic is in its nature merely a convenience of calculation: it belongs essentially to the keeping of accounts; but is merely an incident to the transactions of trade. It is applied, therefore, with unquestionable advantage, to monies of account, as we have done: yet, even in our application of it to the *coins*, we have not only found it inadequate, but in some respects inconvenient. The divisions of the Spanish dollar, as a coin, are not only into tenths, but into halves, quarters, fifths, eighths, sixteenths, and twentieths. We have the halves, quarters, and twentieths, and might have the fifths; but the eighth makes a fraction of the cent, and the sixteenth even a fraction of a mill. These eighths and sixteenths form a very considerable proportion of our metallic currency; and although the eighth dividing the cent only into halves adapts itself without inconvenience to the system, the fraction of the sixteenth is not so tractable; and in its circulation, as small change, it passes for six cents, though its value is six and a quarter, and there is a loss by its circulation of four per cent, between the buyer and the seller. For all the transactions of retail trade, the eighth and sixteenth of a dollar are among the most useful and convenient of our coins: and, although we have never coined them ourselves, we should have felt the want of them, if they had not been supplied to us from the coinage of Spain.' pp. 80—82.—

'It has already been remarked, that the only apparent advantage of substituting an aliquot part of the circumference of the earth, instead of a definite portion of the human body, for the natural unit of linear measure, is, that it forms a basis for a system embracing *all* the objects of human mensuration; and that its usefulness depends upon its application to geography and astronomy, and particularly to the division of the quadrant of the meridian into centesimal degrees. In the novelty of the system, this was attempted in France, as well as the decimal divisions of time, and of the rhumbs of the wind. A French navigator, suffering practically under the attempt thus to navigate, decimally, the ocean, recommended to the national assembly to decree, that the earth should perform four hundred revolutions in a year. The application of decimal divisions to time, the circle, and the sphere, are abandoned even in France. And for all the ordinary purposes of mensuration, excepting itinerary measure, the metre is too long for a standard unit of nature. It was a unit most especially inconvenient as a substitute for the foot, a measure to which, with trifling variations of length, all the European nations and their descendants were accustomed. The foot rule has a property very important to all the mechanical professions, which have constant occasion for its use: it is light, and easily portable about the person. The metre, very suitable for a staff, or for measuring any portion of the earth, has not the property of being portable about the person: and, for all the professions concerned in ship or house building, and for all who have occasion to use mathematical instruments, it is quite unsuitable. It serves perfectly well as a substitute for the yard or ell, the fathom or perch; but not for the *foot*. This inconvenience, great in itself, is made irreparable when combined with the exclusive principle of decimal divisions. The union of the metre, and of decimal arithmetic, rejected all compromise with the foot. There was no legitimate extension of matter intermediate between the ell and the palm, between forty inches and four. This decimal despotism was found too arbitrary for endurance; not only the foot, but its duodecimal divisions, were found to be no arbitrary or capricious institutions, but founded in the nature of the relations between man and things. The duodecimal division gives equal aliquot parts of the unit, of two, three, four, and six. By giving the third and the fourth, it indirectly gives the eighth and the sixteenth, and gives facility for ascertaining the ninth, or third of the third. Decimal division, in giving the half, does not even give the quarter, but by multiplication of the subdivisions. It is incommensurable with the *third*, which unfortunately happened to be the foot, the universal standard unit of the old metrology. The choice of the kilogramme, or cubical decimetre of distilled water, as the single standard unit of weights, with the application to it of the decimal divisions, was followed by similar inconveniences. The pound weight should be a specific gravity easily portable about the person, not only for the convenience of using it as an instrument, but as the measure of quantities to be carried. To the common mass of the people, the use of weights is in the market, or the shop. The article weighed is to be carried home. It is an article of food for the daily subsistence of the individual or his family. As he has not the means of purchasing it in large quantities, it must often be sold in quantities represented by the pound weight, which, like the foot rule, with various modifications, is universally used throughout the European world. Subdivisions of that weight, the half, the quarter of a pound, are often necessary to conciliate the wants and means of the neediest portion of the people; that portion to whom the *justice* of weight and measure is a necessary of life, and to whom it is one of the most sacred duties of the legislator to secure that justice, so far as it can be secured by the operation of human institutions. The half of the kilogramme was nearly equivalent to the ancient Paris pound. But there was in the new system no half, or quarter of a pound; because there was no quarter or eighth of a kilogramme. There was no intermediate weight between the pound, or half kilogramme, and the hectogramme, which was a fifth part of a pound.' pp. 80—83.—

'From the verdict of experience, therefore, it is doubtful whether the advantage to be obtained by any attempt to apply decimal arithmetic to weights and measures, would ever compensate for the increase of diversity which is the unavoidable consequence of change. Decimal arithmetic is a contrivance of man for computing numbers; and not a property of time, space, or matter. Nature has no partialities for the number ten: and the attempt to shackle her freedom with them, will for ever prove abortive.' p. 85.—

'4. The fourth advantage of the French metrology over that which we possess, consists in the convenient proportions, by which the coins and monies of account are adjusted to each other, and to the weights.

'This is believed to be a great and solid advantage; not possessed exclusively by the French system, for it was, in high perfection, a part of the original English system of weights and measures, as has already been shown. It was more perfect in that system, because the silver coins and weights were not merely proportioned to each other, but the *same.* This is not the case with the French coins : and even their *proportions* to the weights are disturbed and unhinged by the mint allowance, or what they call toleration of inaccuracy, both of weight and alloy. This toleration, which is also technically called the *remedy,* ought every where to be exploded. It is in no case necessary. The toleration is injustice : the remedy is disease. If it were the duty of this report to present a system of weights, measures, and coins, all referrible to a single standard, combining with it, as far as possible, the decimal arithmetic, and of which uniformity should be the pervading principle, without regard to existing usages, it would propose a silver coin of nine parts pure and one of alloy : of thickness equal to one-tenth part of its diameter ; the diameter to be one-tenth part of a foot, and the foot one-fourth part of the French metre. This dollar should be the unit of weights, as well as of coins and of accounts ; and all its divisions and multiples should be decimal. The unit of measures of capacity should be a vessel containing the weight of ten dollars of distilled water, at the temperature of ten degrees of the centigrade thermometer : and the cubical dimensions of this vessel should be ascertained by the weight of its contents ; the decimal arithmetic should apply to its weight, and convenient vulgar fractions to its cubical measure. This system once established, the standard weight and purity of the coin should be made an article of the constitution, and declared unalterable by the legislature. The advantage of such a system would be to embrace and establish a principle of uniformity with reference to time, which the French metrology does not possess. The weight would be a perpetual guard upon the purity and value of the coin. No second weight would be necessary or desirable. The coin and the weight would be mutual standards for each other ; accessible, at all times, to every individual. Should the effect of such a system only be, as its tendency certainly would be, to deprive the legislative authority of the power to debase the coins, it would cut up by the roots one of the most pernicious practices that ever afflicted man in civil society. By its connexion of the linear standard with the French metre, it would possess all the advantages of having that for a unit of its measures of length, and a link of the most useful uniformity with the whole French metrology.' pp. 85, 86.—

'5. The last superior advantage of the French metrology is, the *uniformity,* precision, and significancy of its nomenclature.

'In mere speculative theory, so great and unequivocal is this advantage, that it would furnish one of the most powerful arguments for adopting the whole system to which it belongs. In every system of weights and measures, ancient or modern, with which we are acquainted, until the new system of France, the poverty and imperfection of language has entangled the subject in a snarl of inextricable confusion. The original *names* of all the units of weights and measures have been improper applications of the substances from which they were derived. Thus, the foot, the palm, the span, the digit, the thumb, and the nail, have been, as measures, improperly so called, for the several parts of the human body, with the length of which they corresponded. Instead of a specific name, the measure usurped that of the standard from which it was taken. Had the foot rule been unalterable, the inconvenience of its improper appellation might have been slight. But, in the lapse of ages, and the revolutions of empires, the foot measure has been every where retained, but infinitely varied in its extent. Every nation of modern Europe has a foot measure, no two of which are the same. The English foot indeed was adopted and established in Russia by Peter the Great; but the original Russian foot was not the same. The Hebrew shekel and maneh, the Greek mina, and the Roman pondo, were *weights*. The general name *weight* improperly applied to the specific unit of weight. The Latin word libra, still more improperly, was borrowed from the balance in which it was employed: libra was the balance, and at the same time the pound weight. The terms *weight* and *balance* were thus generic terms, without specific meaning. They signified any weight in the balance, and varied according to the varying gravities of the specific standard unit at different times and in different countries. When, by the debasement of the coins they ceased to be identical with the weights, they still retained their names. The *pound* sterling retains its name three centuries after it has ceased to exist as a weight, and after having, as money, lost more than two thirds of its substance. We have discarded it indeed from our vocabulary; but it is still the unit of monies of account in England. The *livre* tournois of France, after still greater degeneracy, continued until the late revolution, and has only been laid aside for the new system. The ounce, the drachm, and the grain, are specific names, indefinitely applied as indefinite parts of an indefinite whole. The English pound avoirdupois is heavier than the pound troy; but the ounce avoirdupois is lighter than the ounce troy. The weights and measures of all the old systems present the perpetual paradox of a whole not equal to all its parts. Even numbers lose the definite character which is essential to their nature. A dozen become sixteen, twenty-eight signify twenty-five, one hundred and twelve mean a hundred. The indiscriminate application of the same generic term to different specific things, and the misapplication of one specific term to another specific thing, universally pervade all the old systems, and are the inexhaustible fountains of diversity, confusion, and fraud. In the vocabulary of the French system, there is one specific, definite, significant word, to denote the unit of lineal measure; one for superficial, and one for solid measure; one for the unit of measures of capacity, and one for the unit of weights. The word is exclusively appropriated to the thing, and the thing to the word. The metre is a definite measure of length: it is nothing else. It cannot be a measure of one length in one country, and of another length in another. The gramme is a specific weight, and the litre a vessel of specific cubic contents, containing a specific weight of water.' pp. 87, 88.—

—'But there is a natural aversion in the mass of mankind to the adoption of words, to which their lips and ears are not from their infancy accustomed. Hence it is, that the use of all technical language is excluded from social conversation, and from all literary composition suited to general reading; from poetry, from oratory, from all the regions of imagination and taste in the world of the human mind. The student of science, in his cabinet, easily familiarizes to his memory, and adopts, without repugnance, words indicative of new discoveries or inventions, analogous to the words in the same science already stored in his memory. The artist, at his work, finds no difficultry to receive or use the words appropriate to his own profession. But the general mass of mankind, of every condition, reluct at the use of unaccustomed sounds, and shrink especially from new words of many syllables. But weights and measures are instruments indispensable, not only to the philosophical student and the professional artist; they are the want of every individual and of every day. They are the want of food, of raiment, of shelter, of all the labors and all the pleasures of social existence. Weights and measures, like all the common necessaries of life, have, in all the countries of modern Europe, customary names of one, or, at most, of two, syllables. The units of the new French system have no more; but their multiples and subdivisions have four or five; and, although compounded of syllables familiar to those who had any acquaintance with the classical languages of Greece and Rome, they had a strange and outlandish sound to the ears of the people in general, who would never be taught to pronounce them. Hence, after an experience of several years, it was found necessary, not only to give back to the people the vulgar fractions of their measures, which had been taken from them, but all their indefinite and many-meaning words of pound and ounce, foot, aune and thumb, boisseau and pint. Since which time there have been, besides all the relics of the old metrology, two concurrent systems of weights and measures in France; one, the proper legal system, with decimal divisions and multiplications, and the new, precise, and significant nomenclature; and the other a system of sufferance, with the same instruments, but divided in all the old varieties of vulgar fractions, and with the old improper vocabulary, made still more so by its adaptation to new and different things.

'Perhaps it may be found, by more protracted and multiplied experience, that this is the only uniformity attainable by a system of weights and measures for universal use: that the same material instruments shall be divisible decimally for calculations and accounts; but in any other manner suited to convenience in the shops and markets; that their appropriate legal denominations shall be used for computation, and the trivial names for actual weight, or mensuration.

'It results, however, from this review to the present condition of the French system in its native country, and from the comparison of its theoretical advantages over that which we already possess, that the time has not arrived at which so great and hazardous an experiment can be recommended, as that of discarding all our established existing weights and measures, to adopt and legalize those of France in their stead. The single standard, proportional to the circumference of the earth; the singleness of the units for all the various modes of mensuration; the universal application to them of decimal arithmetic; the unbroken chain of connexion between all weights, measures, monies, and coins; and the precise, significant, short, and complete vocabulary of their denominations; altogether forming a system adapted equally to the use of all mankind; afford such a combination of the principle of uniformity for all the most important operations of the intercourse of human society; the establishment of such a system so obviously tends to that great result, the improvement of the physical, moral, and intellectual condition of man upon earth; that there can be neither doubt nor hesitation in the opinion, that the ultimate adoption, and universal though modified application of that system, is a consummation devoutly to be wished.' pp. 89, 90.—

There is a great deal of justness, we think, in the foregoing remarks, and we regret that we are obliged to omit others equally novel and discriminating.

It seems very evident, that an undue importance has been attached to the circumstance of referring our measures to a natural standard, as if that would do away all existing varieties, and all the mutabilities effected by time. Though nature, in this case, may be constant, our estimates and deductions must partake of the imperfection and changes that belong to human things. There have been different measurements in France of the same terrestrial arc, made by the ablest astronomers, and with the greatest care, and pains, and expense, which give results materially different, as it respects some parts of the system founded upon them. Other measurements, on other meridians, and in other latitudes, and more especially in the other hemisphere, at other times, and by other methods, would probably lead to conclusions still more discordant. It is to be recollected, moreover, that there is something hypothetical in the process by which the definitive metre, as it now exists, was finally determined. About one tenth part of the quadrant of the meridian was the subject of actual measurement. This arc, though reduced to the level of the sea, was not found to be of a regular curvature, either circular or elliptical. The remaining nine tenths of the quadrant was to be calculated, and it was necessary, not only to assume a certain ratio between the equatorial and polar diameters of the earth, but to take for granted, what the present measurement seemed to disprove, that the meridian of the earth is a true ellipse. The above ratio, according to the most accurate results, has varied from $\frac{1}{300}$ to $\frac{1}{335}$. The measurement just mentioned, taken by itself, would give $\frac{1}{150}$.

But let it be supposed that the metre is precisely what it pretends to be, the ten millionth part of the quadrant of the meridian. There is already as much disagreement as to the actual length in English inches of this *positive* standard, the definitive platina metre deposited in the archives of the French government at Paris, as there is with regard to its natural prototype. Among the latest determinations, and those which pretend to the greatest accuracy, there is a difference of an hundredth of an inch,* a very considerable quantity, when we recollect that the eye is capable of distinguishing to the five hundredth of an inch, without the aid of a microscope, and that in nice experiments upon the comparison of measures, the estimates are often to the hundred thousandth of an inch.

Notwithstanding, therefore, we refer our measures to a permanent standard in nature, it is not this natural, perfect, invariable length, but its imperfect, variable representative in platina or brass, that we are condemned to use; and what is to exempt this from the accidents and discrepancies that have befallen the conventional standards hitherto employed?

The chief recommendation of a natural standard, taken from the circumference of the earth, is, that being adapted to the general use of mankind, it may possibly become the common standard of different nations. Another advantage is, that by the centesimal division of the quadrant of the circle, it admits of a great improvement in nautical, geographical, and other important calculations. It is true that this part of the system is relinquished, partly because it is so difficult to change the habits of men engaged in the practical professions, and partly because their methods, tables, instruments, &c., becoming obsolete, would require to be replaced by new ones, accommodated to the new order of things. It was not to be expected, that so great a revolution in the habits and pursuits of men would take place all at once. When the more essential parts of the system are once firmly established, and men begin to realize the proposed benefit, in all its magnitude and importance, it will be less difficult to adopt those parts that have been discontinued.

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* This difference in the unit of length would lead to a difference in the unit of weight of one thirteen hundredth part.

With regard to the decimal progression, considered as a constituent part of this system, it will probably be long before it is fully adopted, if it is adopted at all. It happens unfortunately in some respects, that the earth's magnitude is such as not to afford us a unit, that is a decimal part of its circumference, and at the same time the best adapted to the uses of society. The almost universal prevalence of a linear measure, approaching to our foot, seems to indicate a peculiar adaptation of this length to human wants. Next to the foot, the measures most used are the yard, ell, or aune, and the fathom, or toise, to each of which the metre is well suited, being nearly equivalent to the yard or ell, and to half the toise or fathom. The French government have authorized the third of the metre to be used under the denomination of foot. There would seem to be less objection to the fourth of the metre being taken for this purpose, as it can be expressed without a vulgar fraction; and it has this particular recommendation, that its tenth part would give us back the inch within a small fraction. It may be observed, moreover, that so far as a correspondence with the dimensions of the human person is of importance, the fourth part of a metre would much more accurately represent the medium length of the natural foot, than the measure now in use.* There would apparently be no more inconvenience in employing this measure as a substitute for the foot, referring still to the metre as the unit, than we now experience in the use of the fourth of a dollar, referring to the dollar as the unit; and probably the occasions for this sum are as much more frequent than those for the dollar, as the occasions for the foot exceed those for the metre. It will be observed, that we have here availed ourselves of the outline of a system so ingeniously sketched by the author of the report, upon which we should be tempted to enlarge, were it not that the bane of all speculation, as well as of legislation relative to this subject, has been the multiplicity of systems.

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* The natural foot is stated to be 9.768 inches. The fourth part of the metre is 9.844 inches.

It is believed, that the difficulty attending the decimal relation of the different denominations of weight and measure, has arisen from previous habits, more than from any inherent incompatibility of such a progression with the purposes to be answered. It is true, that this relation is inconvenient, on account of the small number of divisors belonging to the number ten. But this inconvenience would be greatly outweighed, we think, even with respect to those who have little to do with calculation, by the advantages to be derived from a scale of weights and measures, thus rendered identical with our numerical scale.

That a decimal proportion among weights and measures is capable of meeting the wants of society, seems to be proved by the example of the Chinese, who, it appears, have anticipated us in this reform, as they have in many other things which we of the west claim as our own.* 'The decimal multiplication and subdivision of quantities,' says sir George Staunton, 'used almost in every instance by the Chinese, greatly simplifies their computations. Thus, for example, a *leang*, which is generally equal to an ounce of silver, is subdivided into ten *chen*, the chen into ten *fen*, and the fen into ten *lee*. The ideal subdivisions of money descend much lower, but always, as well as in increasing quantities, in the same decimal proportions.'† Another great advantage in the Chinese system of coins, weights, and measures, is the brevity of the language, almost all the names, not only of the denominations of money, as here given, but also of those applied to weight and measure, being monosyllables. These names, taken together, contain in fact fewer syllables than the corresponding ones of the so much admired French system, and would probably have met with less opposition by the mass of the French nation. We would further remark, that it is on account of this decimal proportion, that the Chinese are able to make their mercantile computations with so much facility and despatch, by means of the *swan pan*, a very simple mechanical instrument, consisting of a sort of beads strung upon wires, but which admirably represents the scale of numbers, according to the decimal notation.

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* It is maintained upon apparently good authority, that the Chinese have been before us in the use of the mariner's compass, the art of printing, gunpowder, and inoculation for the small pox.

† Macartney's Embassy to China, vol. ii. p. 265. See also the New Edinburgh Encyclopedia, art. *China*.

If the units of the French system could be introduced without too violent an innovation, the decimal divisions and multiples would naturally follow in the course of time. They would probably be adopted almost immediately by persons engaged in scientific pursuits, and they would greatly extend that community of language, which already exists with regard to abstract numbers, the mathematical and physical sciences, the divisions of the day, of the year, and of the circle. There need be no more confusion arising from different divisions and multiples of the same units, than has proceeded from a similar state of our money system, than is now experienced from the not unfrequent application of decimal arithmetic to our present measures and weights. Much beyond this is not perhaps to be expected. The language of science and philosophy must always be in a degree different from that in common use, but it is of great importance that both should be such as to admit of an easy translation from one into the other.

As, therefore, the general adoption, at least of the leading features, of a philosophical system of weights and measures, like that of France, would be of such eminent service to the cause of human improvement, the most powerful considerations are presented in the report before us with a view to the attainment of this great end.

—'As final and universal uniformity of weights and measures is the common desideratum for all civilized nations; as France has formed, and for her own use has established, a system, adapted, by the highest efforts of human science, ingenuity, and skill, to the common purposes of all; as this system is yet new, imperfect, susceptible of great improvements, and struggling for existence even in the country which gave it birth; as its universal establishment would be an universal blessing; and as, if ever effected, it can only be by consent, and not by force, in which the energies of opinion must precede those of legislation; it would be worthy of the dignity of the Congress of the United States to consult the opinions of all the civilized nations with whom they have a friendly intercourse; to ascertain, with the utmost attainable accuracy, the existing state of their respective weights and measures; to take up and pursue, with steady, persevering, but always temperate and discreet exertions, the idea conceived, and thus far executed, by France, and to co-operate with her to the final and universal establishment of her system.

'But, although it is respectfully proposed that Congress should immediately sanction this consultation, and that it should commence, in the first instance, with Great Britain and France, it is not expected that it will be attended with immediate success. Ardent as the pursuit of uniformity has been for ages in England, the idea of extending it beyond the British dominions has hitherto received but little countenance there. The operation of changes of opinion there is slow; the aversion to all innovations, deep. More than two hundred years had elapsed from the Gregorian reformation of the calendar, before it was adopted in England. It is to this day still rejected throughout the Russian empire. It is not even intended to propose the adoption by ourselves of the French metrology for the present. The reasons have been given for believing, that the time is not yet matured for this reformation. Much less is it supposed advisable to propose its adoption to any other nation. But, in consulting them, it will be proper to let them understand, that the design and motive of opening the communication is, to promote the final establishment of a system of weights and measures, to be common to all civilized nations.

'In contemplating so great, but so beneficial a change, as the ultimate object of the proposal now submitted to the consideration of Congress, it is supposed to be most congenial to the end, to attempt no present change whatever in our existing weights and measures; to let the standards remain precisely as they are; and to confine the proceedings of Congress at this time to authorizing the Executive to open these communications with the European nations where we have accredited ministers and agents, and to such declaratory enactments and regulations, as may secure a more perfect uniformity in the weights and measures now in use throughout the Union.

'The motives for entertaining the opinion, that any change in our system at the present time would be inexpedient, are four:

'First, That no change whatever of the system could be adopted, without losing the greatest of all the elements of unformity, that referring to the persons using the same system. This uniformity we now possess, in common with the whole British nation; the nation with which, of all the nations of the earth, we have the most of that intercourse which requires the constant use of weights and measures. No change is believed possible, other than that of the whole system, the benefit of which would compensate for the loss of this uniformity.

'Secondly, That the system, as it exists, has an uniformity of proportion very convenient and useful, which any alteration of it would disturb, and perhaps destroy; the proportion between the avoirdupois and troy weights, and that between the avoirdupois weight and the foot measure; one cubic foot containing of spring water exactly one thousand ounces avoirdupois, and one pound avoirdupois consisting of exactly seven thousand grains troy.

'Thirdly, That the experience of France has proved, that binary, ternary, duodecimal, and sexagesimal divisions, are as necessary to the practical use of weights and measures, as the decimal divisions are convenient for calculations resulting from them; and that no plan for introducing the latter can dispense with the continued use of the former.

'Fourthly, that the only *material* improvement, of which the present system is believed to be susceptible, would be the restoration of identity between weights and silver coins; a change, the advantages of which would be very great, but which could not be effected without a corresponding and almost total change in our coinage and monies of account: a change the more exceptionable, as our monetary system is itself a new, and has hitherto been a successful institution.

'Of all the nations of European origin, ours is that which least requires any change in the system of their weights and measures. With the exception of Louisiana, the established system is, and always has been, throughout the union, the same. Under the feudal system of Europe, combined with the hierarchy of the church of Rome, the people were in servitude, and every chieftain of a village, or owner of a castle, possessed or asserted the attributes of sovereign power. Among the rest, the feudal lords were in the practice of coining money, and fixing their own weights and measures. This is the great source of numberless diversities existing in every part of Europe, proceeding not from the varieties which in a course of ages befell the same system, but from those of diversity of origin. The nations of Europe are, in their origin, all compositions of victorious and vanquished people. Their institutions are compositions of military power and religious opinions. Their doctrines are, that freedom is the grant of the sovereign to the people, and that the sovereign is amenable only to God. These doctrines are not congenial to nations originating in colonial establishments. Colonies carry with them the general laws, opinions, and usages, of the nation from which they emanate, and the prejudices and passions of the age of their emigration. The North American colonies had nothing military in their origin. The first English colonies on this continent were speculations of commerce. They commenced precisely at the period of that struggle in England between liberty and power, which, after long and bloody civil wars, terminated in a compromise between the two conflicting principles. The colonies were founded by that portion of the people, who were arrayed on the side of liberty. They brought with them all the rights, but none of the servitudes, of the parent country. Their constitutions were, indeed, conformably to the spirit of the feudal policy, charters granted by the crown; but they were all adherents to the doctrine, that charters were not donations, but compacts. They brought with them the weights and measures of the law, and not those of any particular district or franchise. The only change which has taken place in England with regard to the legal standards of weights and measures, since the first settlement of the North American colonies, has been the specification of the contents of measures of capacity, by prescribing their dimensions in cubical inches. All the standards at the exchequer are the same that they were at the first settlement of Jamestown; with the exception of the wine gallon, which is of the time of queen Anne: and the standards of the exchequer are the prototypes, from which all the weights and measures of the union are derived.' pp. 91—94.

The official reports, above alluded to, upon the weights and measures, as authorized by the different state legislatures, and upon the state of the weights and measures used at the several custom houses in the United States, and other valuable documents appended to this work, we are obliged to leave unnoticed. Our limits will only admit of the following recapitulation of the propositions finally submitted to Congress for their adoption.

'The plan which is thus, in obedience to the injunction of both houses of Congress, submitted to their consideration, consists of two parts, the principles of which may be stated: 1. To fix the standard, with the partial uniformity of which it is susceptible, for the present, excluding all innovation. 2. To consult with foreign nations, for the future and ultimate establishment of universal and permanent uniformity. An apology is due to Congress for the length, as well as for the numerous imperfections, of this report. Embracing views, both theoretic and historical, essentially different from those which have generally prevailed upon the subject to which it relates, they are presented with the diffidence due from all individual dissent encountering the opinions of revered authority. The resolutions of both houses opened a field of inquiry so comprehensive in its compass, and so abundant in its details, that it has been, notwithstanding the lapse of time since the resolution of the Senate, as yet but very inadequately explored. It was not deemed justifiable to defer longer the answer to the calls of both houses, even if their conclusion from it should be the propriety rather of further inquiry than of immediate action. In freely avowing the hope that the exalted purpose, first conceived by France, may be improved, perfected, and ultimately adopted by the United States, and by all other nations, equal freedom has been indulged in pointing out the errors and imperfections of that system, which have attended its origin, progress, and present condition. The same liberty has been taken with the theory and history of the English system, with the further attempt to shew that the latter was, in its origin, a system of beauty, of symmetry, and of usefulness, little inferior to that of modern France.

'The two parts of the plan submitted are presented distinctly from each other, to the end that either of them, should it separately obtain the concurrence of Congress, may be separately carried into execution. In relation to weights and measures throughout the Union, we possess already so near an approximation to uniformity of law, that little more is required of Congress for fixing the standard than to provide for the uniformity of fact, by procuring and distributing to the executives of the states and territories positive national standards conformable to the law. If there be one conclusion more clear than another, deducible from all the history of mankind, it is the danger of hasty and inconsiderate legislation upon weights and measures. From this conviction, the result of all inquiry is, that, while all the existing systems of metrology are very imperfect, and susceptible of improvements involving in no small degree the virtue and happiness of future ages; while the impression of this truth is profoundly and almost universally felt by the wise and the powerful of the most enlightened nations of the globe; while the spirit of improvement is operating with an ardor, perseverance, and zeal, honorable to the human character, it is yet certain, that, for the successful termination of all these labors, and the final accomplishment of the glorious object, permanent and universal uniformity, legislation is not alone competent. A concurrence of will is indispensable to give efficacy to the precepts of power. All trifling and partial attempts of change in our existing system, it is hoped, will be steadily discountenanced and rejected by Congress; not only as unworthy of the high and solemn importance of the subject, but as impracticable to the purpose of uniformity, and as inevitably tending to the reverse, to increased diversity, to inextricable confusion. *Uniformity* of weights and measures, permanent, universal uniformity, adapted to the nature of things, to the physical organization and to the moral improvement of man, would be a blessing of such transcendent magnitude, that, if there existed upon earth a combination of power and will, adequate to accomplish the result by the energy of a single act, the being who should exercise it would be among the greatest of benefactors of the human race. But this stage of human perfectibility is yet far remote. The glory of the first attempt belongs to France. France first surveyed the subject of weights and measures in all its extent and all its compass. France first beheld it as involving the interests, the comforts, and the morals, of all nations and of all after ages. In forming her system, she acted as the representative of the whole human race, present and to come. She has established it by law within her own territories ; and she has offered it as a benefaction to the acceptance of all other nations. That it is worthy of their acceptance, is believed to be beyond a question. But *opinion* is the queen of the world ; and the final prevalence of this system beyond the boundaries of France's power must await the time when the example of its benefits, long and practically enjoyed, shall acquire that ascendency over the opinions of other nations, which gives motion to the springs and direction to the wheels of power.' pp. 133—135.

Art. XII.—1. *Public documents relating to the New York canals, which are to connect the western and northern lakes with the Atlantic ocean ; with an introduction. Printed under the direction of the New York corresponding association for the promotion of internal improvements.* New York, 8vo, pp. 536, 1821.

2. *History of the rise, progress, and existing condition of the western canals in the state of New York, from September* 1788 *to the completion of the middle section of the Grand Canal, in* 1819 *; together with the rise, progress, and existing state of modern agricultural societies on the Berkshire system, from* 1807 *to the establishment of the Board of Agriculture in the state of New York, January* 10, 1820. *By Elkanah Watson.* Albany, 8vo, pp. 210. 1820.

3. *A vindication of the claim of Elkanah Watson Esq. to the merit of projecting the lake canal policy, as created by the canal act of March* 1792. *And also a vindication of the*